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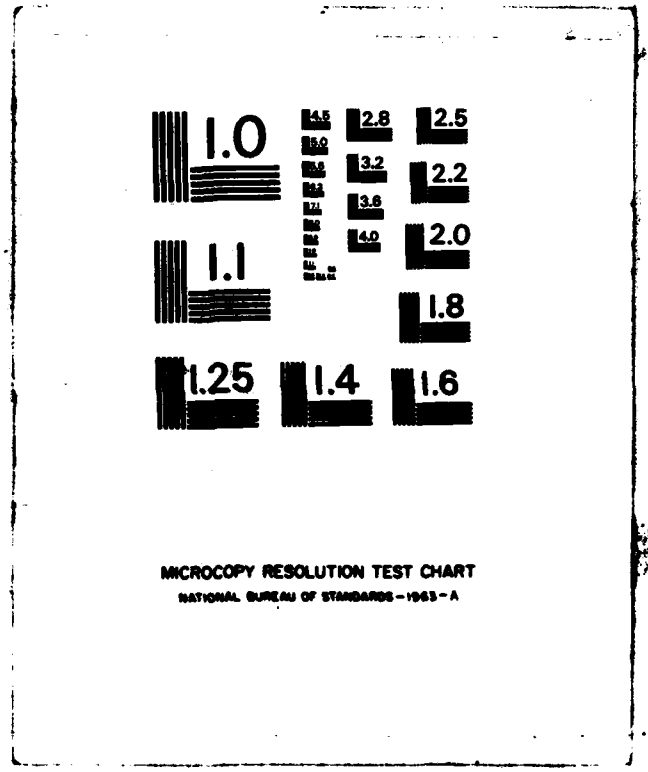
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FOREIGN TECHNOLOGY DIVISION

COAXIAL CABLES FOR 10,800-CALL TELEPHONY

by

Tadeusz Lapinski

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COAXIAL CABLES FOR 10,800-CALL TELEPHONY

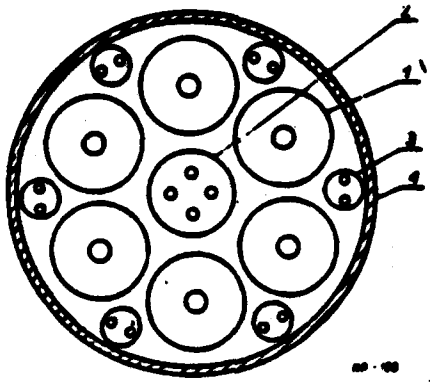
Tadeusz Lapinski

Long distance telecommunication cables with coaxial pairs of normal dimensions of the type 2.6/9.5 mm produced since 1961, are used in 2700-call telephony in the frequency band up to 12.5 MHz. The increase of telephone traffic and its automization call for the creation of a large number of connections. A solution to this problem is possible through multiple-call cable routes.

The Research and Development Center of the Cable Industry is carrying work on adaptation of normal-size coaxial cables to 10,800-call telephony utilizing the frequency band up to 60 MHz. This work led in 1979 to the production of three cables by Cracow Cable Factory.

On each two coaxial pairs it will be possible to make 10,800 simultaneous telephone connections. It means also the four-fold reduction of the consumption of copper used for telephone connections, in comparison with cables currently produced. Presently, cables with four and six coaxial pairs are made. The first of them can form 21,600 connections, and the second - 32,400 connections. An example of the construction of cables with six coaxial pairs is shown in the Figure.

The cables comply with recommendation G.623 of the International Advisory Committee for Telephony and Telegraphy (CCITT) and satisfy technological-use requirements established by the Institute of Communications.



Cross section of the cable
TKDW 6x2.6/9.5+1x4x1.2+6x2x0.5

1 - coaxial pairs
2 - symmetric foursome
3 - symmetric pairs
4 - protective cover

Periodic transmission nonuniformities of coaxial pairs, whose consequence was large reflections (echoes) near the frequency at 45 MHz, were eliminated by a change in the technology of production. The effectiveness of screening was improved considerably by using the optimal structure of the multilayer screen which is the subject of the patent PRL No. 96,309. The application of this screen with an optimal structure produced large penetrating decays between coaxial pairs in the frequency band 0.3 - 65 MHz (more than 170 dB in a sector of length 350 m). The use of softened copper wire produced frequency characteristics of wave decay for the coaxial pair 2.6/9.5 mm in conformity with recommendations of CCITT.

The resistance of the internal strand for direct current at a temperature of 20°C does not exceed 3.6 Ω/km, and for the external strand - 2.5 Ω/km.

The insulation of coaxial pairs can withstand without damage, in a period of two minutes, the test constant potential of 3700 V. The resistance of insulation between strands is larger than 10,000 MΩ/km. The effective capacity is 47 nF/km.

The real component of the wave impedance at the frequency of 2.5 MHz for each coaxial pair is 75 ± 1 Ω. The largest difference between the real components of the impedance of all coaxial pairs at one end of each fabrication section does not exceed 0.25Ω for 80 percent of the fabrication sections and 0.10Ω for 100 percent of the fabrication sections, and the largest difference between these components at the beginning and end of the fabrication section does not exceed 0.25 and 0.40Ω correspondingly. The wave decay at the frequency of 2.5 MHz is 3.72 dB/km, and at the frequency of 60 MHz - 18.4 dB/km.

The wave decay (signal loss) α of the coaxial pair at the sufficient accuracy in practice, by the following relation

$$\alpha = 2{,}34 \cdot \sqrt{f} + 0{,}0043 \cdot f \left[\frac{\text{dB}}{\text{km}}\right]$$

where f is in MHz.

The echo (nonuniformity) coefficient, measured by the impulse of duration time at the half-height equal approximately to 10 ns, does not exceed 2.5 o/oo for 95 percent of the measured pairs and 4.5 o/oo for 100 percent of the measured pairs. Measurements have shown that values of the echo coefficient do not exceed in general 0.5 o/oo, and infrequent jumps lie below 1 o/oo. Such a good uniformity was achieved thanks to the construction of a screen from two steel tapes wound in opposite directions, and intersecting at an angle close to a straight one. The optimal screen forms a good protection of the external strans against mechanical deformations.

The decay (loss) of penetration between coaxial pairs in a fabrication section with a length of about 200 m, in the frequency band 0.3 - 60 MHz, is larger than 150 dB. Measurements of the penetration decay on a section of cable 361 m long have shown that they are larger than 170 dB at frequencies higher than 200 kHz.

The coaxial cables for 10,800-call telephony will be used on main lines of the long distance telecommunication network.